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MINERALOGY.[1]

RECENT BOOKS.

Fletcher. The Optical Indicatrix and the Transmission of Light in Crystals.[2]—This treatise is an important one for mineralogical students because of its simple form and style and its easy mathematical demonstrations. It is Fletcher's opinion that, since Fresnel's hypothesis that the medium for transmission of light—the ether—is incompressible, has been shown to be untenable, it should be abandoned by teachers. The newer theory of Neumann and MacCullagh that the ether is compressible, he supports, but wisely advises that since we may be dealing with only an approximate mechanical analogy, it is best to make use of terms which do not commit one to either of the hypotheses. The surface of elasticity he proposes to call the *optical indicatrix.* The wave surface of Fresnel he prefers to call the *ray surface,* and *ray front* is substituted for wave front. The plane passing through the ray and the normal to the plane of polarization, he designates simply as the *transverse plane.* The optic axes of biaxial crystals are called *bi-normals,* and the "secondary optic axes," or directions of common ray velocity, he calls *bi-radials.* The author shows that Fresnel did not, as supposed, arrive at the wave surface as a deduction from his theory of the incompressible elastic ether, but by a simple generalization before his theory of the ether was developed. Chapter II, of Fletcher's work, is devoted to the evolution of the optical indicatrix, and begins by remarkably simple statements of the accepted views concerning the nature of light, its transmission in isotropic media, reflection, refraction, polarization, etc., with the facts on which they are based. The ray surface and indicatrix are then developed from empirical data. It is unfortunate that the printing of the book should have been so badly done. It has been translated into German by Ambronn and König[3].

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[1] Edited by Dr. Wm. H. Hobbs, University of Wisconsin, Madison, Wis.

[2] The Optical Indicatrix and the Transmission of Light in Crystals, By L. Fletcher, M. A., F. R. S. Pp. xii and 112. Henry Frowde, London, 1892. (Reprinted from the Mineralogical Magazine).

[3] Die Optische Indicatrix, Eine geometrische Darstellung der Lichtbewegung in den Krystallen, von L. Fletcher, uebersetzt von H. Ambronn u. W. König. Pp. ix and 69. Barth, Leipzig, 1893. Price, M. 3.

Hecht. Introduction to the Calculation of Crystals.[4]—The author of this valuable little book states in his preface that it gives by the method which originated with him, the general solution to the problems which arise in the calculation of crystals, and outlines a course which must, in every case, lead to the result. The necessary mathematical formulæ recommended are not difficult. A simple method is also given for making the stereographic and parallel projections. Numerous examples for practice are included in the book.

Behrens. Manual of Microchemical Analysis.[5]—This most valuable handbook is the best that has appeared treating the subject of microchemical analysis. Its appearance first in English, for it will undoubtedly be translated into German, is especially fortunate for American students. The book was written in English by Professor Behrens and edited by Professor Judd. The introductory chapter by the latter is an excellent resumé of the mechanical and chemical methods of modern petrography. Besides devising many new methods, Behrens has rigorously tested all the older ones, and furnishes data in this handbook showing the reliability and delicacy of each method. He has been careful to insure that errors arising from the differences in conditions of crystallization shall be excluded. As is well-known, the principle of Behrens' method is to get the element to be determined in the form of a sulphate, the basis for the reactions. He insists that micro-chemical reactions, to come into general use, must be suited to work with a minimum of material and secure results in a minimum of time. Part I of the work describes apparatus and reagents and the reactions which determine each element. Part II gives a systematic scheme of analysis, and has special sections for the examination of water, ores, rocks, alloys, and combinations of the rare elements. The book is full of ingenious suggestion, and should be in the library of every petrographer.

Baumhauer. Results of Methods of Etching in Crystallographical Investigation.[6]—Baumhauer, who, more than anyone else has developed the elegant and accurate methods of etching crystals, gives us in the introduction of this work a most admirable resumé of the work that has been done and the methods that are in common use. Not only etched figures (Aetzfiguren or Aetzgrübchen), but v. Ebner's Lösungsgestalten, Hamberg's Prärosionsflächen, and Becke's Lösungsoberflächen are discussed. The studies of Meyer, Penfield, and Gill, on the forms derived by prolonged etching of spheres ,of quartz with hydrofluoric acid and the alkaline carbonates, and those of Hamberg on forms assumed by cylinders of Iceland spar etched with hydrochloric acid, are correlated. The author discusses in detail the application of the methods of etching to the determination of isomorphous relations. The greater part of the work is devoted to detailed descriptions of a number of important minerals on which the study of etched figures has been of special significance. Among these are the minerals: cryolite, apatite, Zinnwaldite, dolomite, nepheline, datolite, leucite, and boracite. The plates are particularly beautiful, and are suited to lecture demonstration.

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[4] Anleitung zur Krystallberechnung von Dr. Benno Hecht. Pp. 76, with 1 pl. and 5 oiled paper charts to be used in stereographic projection. Barth, Leipzig, 1893.

[5] A Manual of Microchemical Analysis, by Professor H. Behrens, with an introductory chapter by Professor John W. Judd. Pp. xxv and 246 and 84 cuts. MacMillan & Co., London and New York, 1894. Price, $1.50.

[6] Die Resultate der Aetzmethode in der krystallographischen Forschung, an einer Reihe von krystallisirten Körpen dargestellt von Dr. H. Baumhauer. Pp. 131, 21 cuts, and an atlas of 12 plates. Wilhelm Engelmann, Leipzig, 1894. Price, M. 16.

Czapski. Theory of Optical Instruments.[7]—Mineralogists and petrographers who have occasion to test the working or to determine the constants of compound microscopes, will find this recent work of the scientific expert of the Zeiss Optical Works at Jena of much practical utility. The greater part of the work is devoted to a complicated mathematical exposition of Abbe's theories of optical instruments, this latter term being interpreted to include only those instruments which form images of external objects, chief among which are the eye, camera lens, microscope, and telescope. The portion, however, which will find most use among mineralogists and petrographers, is included in the last two chapters. Here the compound microscope, with its modern accessories, is described in respect to construction and use, and methods are given for the practical determination of its optical constants.

Fuess. Instrument Catalogue.[8]—R. Fuess, the well-known goniometer and microscope maker, has issued a supplement to his catalogue of 1891. The supplement treats of goniometers, universal apparatus, microscopes (with many recently devised attachments), grinding apparatus, mounting materials and collections of thin sections.

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[7] Theorie der optischen Instrumente nach Abbe, von Dr. Siegfried Czapski. Trewendt, Breslau, 1893. Price, M. 9.60. (Reprinted from Vol. II of Winkelmann's Handbuch der Physik.)

[8] Ergänzungen zum Preis-Verzeichnisse 1891, über krystallographische und petrographische Instrumente, von R. Fuess, Berlin-Steglitz, 1894. Pp. 56.

The catalogue is very greatly increased in value by its references to the literature on the construction and use of each piece of apparatus which it describes.

Klockmann. Text-Book of Mineralogy.[9]—While the English language can boast the best completed reference work on mineralogy—the sixth edition of Dana's System—it is a lamentable fact that it does not possess a single modern class text of the subject. In contrast with this, the Germans have several, the best being those of Tschermak and Bauer. To these has been recently added another by Klockmann, the Professor of Mineralogy and Geology in the Royal Mining School at Clausthal. Klockmann's text is somewhat shorter than any of the others, having but 467 pages (Tschermak, 606; Bauer, 562), but by means of synoptic descriptions and abbreviations in the systematic portions, it is made to include nearly as much material. The book is a very valuable acquisition, and, to the writer of these notes, seem to possess some advantages over either Tschermak or Bauer for the use of its material in the general courses of American universities and colleges. Excellent judgment has been shown in the selection and arrangement of material, and, perhaps, because of the author's position in a mining academy, the minerals which are of economic importance are given more prominence, and more stress is laid upon the geological occurrence and the mineral association than upon the list of localities. The great aid to the memory which the dualistic formulæ furnish seems to be a sufficient reason for making use of them with elementary classes. In view of the general adoption of the index symbols, either alone or with the Naumann's symbols, it will probably be questioned whether it is wise to make exclusive use of the latter symbols in a text-book, but it is difficult to give students familiarity with both systems at the outset without drawing too much of their attention from more important matters, and the student finds it easier to deal with parameters than with indices. The section on the optical properties of minerals is probably the best in the book. In the descriptive portion, symbols, abbrevations, italics, and small type have been used to excellent advantage to aid the eye in referring to the descriptions and to indicate degrees of importance of the subject matter. In the appendix is included, first, synoptical statements concerning minerals of economic importance—ores, gems, etc.; and, second, a key for the determination of the common minerals from an examination of their physical properties.

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[9] Lehrbuch der Mineralogie für Studierende und zum Selbstunterricht, bearbeitet von Dr. F. Klockmann. Pp. xii and 467, with 430 cuts in the text. Enke, Stutgart, 1892. Price, M.

American mineralogists will look forward with interest to the textbook of mineralogy which is now in preparation for MacMillan & Co., by Mr. H. A. Miers, of the British Museum.

W. H. HOBBS.

PETROGRAPHY.[1]

Granite Inclusions in Gabbro.—Inclusions of granite in the gabbro of the Cuillin Hills, Skye, England, afford excellent illustrations of the effects produced by the fusion of acid rocks on a molten basic one. The granite in question is reported by Judd[2] to be a biotite or a hornblende-biotite variety. Near the periphery of the mass the biotite and hornblende are replaced by augite, and granophyre is developed in the interstices between the phenocrysts. The gabbro, in its passage upward, broke fragments from this granite, especially from its peripheral portions, and changed them completely. The granophyric intergrowth was fused and changed to a rhyolitic glass, marked by flow lines and filled with spherulites and lithophysae. In a few instances, some of the larger granophyre groups have escaped complete fusion, in which case, their remnants remain as nuclei of large compound spherulites. Imbedded in the glass are the large crystals of the granite. The quartzes have been cracked, and into the cracks glassy material has been pressed. The feldspars are also cracked, and in the crevices thus formed, secondary feldspars have been deposited. The original augites have disappeared, and in their places are aggregates of magnetite and other secondary products. The most interesting features of the altered inclusions are the spherulites. Simple and composite varieties are both common, and the trichitic kinds described by Cross are also met with. The centers of the spherulites are nearly always grains of quartz or of orthoclase, or groups of granophyre, as already mentioned. Pyrite and fayalite are both new products of the metamorphic action.

The Geology of Pretoria, South Africa.—A long and interesting account of the geology of the gold fields near Pretoria, in the

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[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Maine.

[2] Quart. Jour. Geol. Soc., xlix, p. 175.